



*Aerial view of refuge canoe trail  
USFWS Photo by S. Jewell*

## *IV. Management Direction*

### **Introduction**

Described below are a vision statement, goals, and proposed plan for managing the refuge over the next 15 years. Contained in the proposed plan are the goals, objectives, and strategies for achieving the refuge vision.

The planning team evaluated three other alternatives for managing the refuge, and chose the Ecosystem Emphasis as the preferred alternative. The other alternatives evaluated were Maintain Current Management, Biological Emphasis, and Public Use Emphasis. These alternatives are described in the Alternatives section of Appendix A.

In essence, the preferred alternative will result in increased exotic plant eradication and control, increased water quality, delivery and timing, increased protection of trust species, protection of migratory songbird stopover sites, restoration of wetland impoundments, enhanced resident wildlife populations and improved long-term opportunities for wildlife-dependent recreation, environmental education and interpretation.

A common thread through this proposed plan is that wildlife conservation assumes first priority in refuge management. Public uses are allowed if they are compatible and appropriate with wildlife and habitat conservation. Specifically, wildlife-dependent recreation uses (wildlife observation, wildlife photography, hunting, fishing, environmental education and interpretation) will be emphasized.

### **Refuge Vision**

The planning team, in conjunction with public meetings and draft reviews of this plan, has developed the following vision for the Arthur R. Marshall Loxahatchee National Wildlife Refuge to guide its present and future management direction:

*To serve as an outstanding showcase for ecosystem management that restores, protects and enhances a portion of the unique northern Everglades biological community. This public asset provides for the enjoyment and enhanced quality of life for present and future generations.*

## Refuge Goals

The following four goals were developed in keeping with refuge vision and purpose:

- Restore and conserve the natural diversity, abundance and ecological function of refuge flora and fauna.
- Conserve natural and cultural resources through partnerships, protection and acquisition from willing sellers.
- Develop and implement compatible wildlife-dependent recreation and environmental education programs that lead to enjoyable experiences and greater understanding of the Everglades.
- Continue a partnership with the District through license renewal. Continue the development of an effective and productive staff to achieve the vision, goals, and objectives of this plan.

## Proposed Management Plan

### *Summary Statement*

The refuge will be managed using an ecosystem approach to maintain natural processes or to mimic those processes such as fire and water regimes. In doing so, the refuge will be managed to meet the needs of the resources and allow greater public access for wildlife observation, wildlife photography, hunting, fishing, and environmental education and interpretation. Comments made during the public scoping meeting and written comments conveyed both a desire for increased public access and recreation, and a desire to preserve the solitude and naturalness of the refuge. The decisions to allow or to prohibit certain uses were dependent upon whether the proposed uses would have an adverse effect on the natural resources of the refuge (*see Appendix A; VI Environmental Consequences, Table 17, Appendix D and Appendix J*) and upon the professional judgement of the planning team.

The proposed management plan outlines how the wildlife populations and associated habitats will be enhanced by the Fish and Wildlife Service over the next 15 years. The goals, objectives and strategies are a recognition that the refuge is a portion of the much larger Everglades ecosystem (CCP; South Florida Section). The actions considered and taken in implementing this plan will affect the remaining Everglades ecosystem south of the refuge, the natural areas to the southwest of the refuge and nearby municipalities and landowners.

Appropriate water quality, quantity, timing and delivery are critical to achieve refuge objectives and those of the Everglades ecosystem, of which the refuge is a part. Water management will rely upon developing progressive partnerships with the South Florida Water Management District and the Army Corps of Engineers. Another crucial element of this plan is controlling exotic and invasive plants and pursuing funding to eliminate these refuge threats. This alternative also enhances biological and research programs including extensive inventorying, Geographic Information System mapping, and monitoring of the wildlife and habitat resources at the refuge. Prescribed fire will be used as an important tool for managing wildlife habitat. All of the compartments (2,030 acres) will be actively managed to enhance wildlife habitat.

The previously closed Strazzulla Marsh will be opened to the public on a limited basis and new facilities will be developed to include an interpretive trail, a boardwalk, an observation tower and possibly a pole-boat trail. Parking access is will be partnered with the Village of Wellington and the Acme Drainage District. Facilities at the headquarters area will be expanded or upgraded. A concession will be developed at Hillsboro Recreation Area to enhance appropriate, compatible, wildlife-dependent recreation. This plan will increase hunting accessibility, acreage and the

number of huntable species. The environmental education program will be enhanced to showcase the northern Everglades ecology and human influence on the southeast Florida ecosystem. A wide range of partnering opportunities will be actively pursued and fostered to protect natural and cultural resources.

### *Goals, Objectives, and Strategies*

The goals, objectives, and strategies presented below are the Service's response to the issues and concerns expressed by the planning team, by the public at the public scoping meeting, and comments submitted by the public. Those issues addressed but not accepted are discussed in Appendix J. The goals, objectives, and strategies are presented in a hierarchical format. Following each goal is a list of objectives, and under each objective, is a listing of strategies indicated as bulleted items.

These objectives and strategies reflect the Service's commitment to achieve the mandates of the National Wildlife Refuge System Improvement Act of 1997, the mission of the National Wildlife Refuge System, Executive Order 13123 Invasive species of 1999, the Endangered Species Act, the Central and South Florida Comprehensive Everglades Restoration Plan, the Everglades Construction Project, and the purpose, vision, and goals for the refuge. With adequate staffing and funding, outlined in the Plan Implementation section, the Service intends to accomplish these goals, objectives, and strategies during the next 15 years.

### *Goal 1. Wildlife Habitat and Population Management*

Restore and conserve the natural diversity, abundance, and ecological function of refuge flora and fauna.

#### *Discussion:*

Water is the life-blood of the Everglades and every effort will be made to monitor water quality, quantity, timing and delivery. This will include testing for pesticides, fertilizers, herbicides and elemental contaminants in all refuge waters including the impoundments, cypress swamp, Strazzulla Marsh and interior. Water management will rely upon developing progressive partnerships with the South Florida Water Management District and the Army Corps of Engineers. Exotic and invasive plants are a major threat to the whole Everglades ecosystem and especially to the refuge. An Integrated Pest Management Plan will be developed to attack this extensive problem. Approximately 71,000 acres infested with melaleuca and 25,000 acres infested with Old World climbing fern will be reduced to a level that requires minimal maintenance. The Everglades ecosystem evolved under the influences of wildfire and the refuge will implement a fire management program that enhances native plant communities. Prescribed fire will also be used to remove exotic and invasive plant biomass and to control new exotic/invasive plant growth in treated areas. All of the compartments (2,030 acres) will be actively managed to enhance wildlife habitat. To be enhanced are the biological and research programs, including extensive inventorying, Geographic Information System mapping, and monitoring of wildlife and habitat. The emphasis of the biological program will be to protect, maintain and enhance wildlife populations and native habitats on the refuge and a step-down management plan will be developed to detail these methods.

## Objectives:

1. Continue to partner with the South Florida Water Management District and the Corps of Engineers to restore and maintain healthy water regimes for 143,238 acres of the refuge as part of the northern Everglades.
  - Evaluate and monitor hydrologic conditions on the refuge.
  - Review and improve the existing hydrologic model for the refuge to more closely predict wildlife population and vegetative community responses to changes in water levels and water delivery.
  - Assess the impacts of the previous, current and future water regulation schedules regarding quality, quantity, delivery and timing of water on native and exotic and invasive species and habitats.
  
2. Expand water quality monitoring to include pesticides, fertilizers, herbicides and elemental contaminant levels in the cypress swamp, compartments, Strazzulla Marsh and the refuge interior by 2002.
  - Work with state and federal agencies, universities and other parties associated with the Everglades Construction Project and Comprehensive Everglades Restoration Plan.
  - Continue to monitor nutrient levels and add new monitoring sites at all water inflows of the refuge not currently being monitored.
  - Improve the water quality in the cypress swamp.
  - Develop a Water Quality Monitoring Plan by 2002.
  
3. Reduce exotic melaleuca and Old World climbing fern to a level that requires minimal maintenance in 15 years and restore treated areas with native plants as needed.
  - Develop a Draft Integrated Pest Management Plan by 2002.
  - Inventory and map the distributions of invasive and exotic plant species, and using Geographic Information Systems, map all exotic and treatment areas.
  - Develop eradication and control programs for invasive and exotic species.
  - Develop restoration programs for native habitats.
  - Review and update the existing Melaleuca Management Plan by 2002.
  - Develop a complete Lygodium/Old World Climbing Fern Management Plan in conjunction with other natural resource agencies and researchers by 2002.
  - Aggressively pursue funding for the removal of exotic plants.
  - Foster partnerships with organizations and agencies addressing common issues, including those which are developing bio-control agents.
  
4. Monitor, control or eradicate exotic or invasive animal threats.
  - Develop a Draft Integrated Pest Management Plan by 2002.
  - Inventory and map the distributions of invasive and exotic animal species, and using Geographic Information Systems, map all exotic and treatment areas.
  - Develop control programs for invasive and exotic animal species.
  - Develop a complete Exotic Animal Management Plan by 2002.
  - Aggressively pursue funding for the removal of exotic animals.
  - Foster partnerships with organizations and agencies addressing common issues, including those which are developing bio-control agents.

5. Implement a fire management program to simulate the historical Everglades ecosystem fire regime where appropriate, enhancing native plants and deterring invasive and exotic plant spread by January 2004.
  - Re-write the Fire Management Plan to manage appropriate refuge habitats by 2002.
  - Update the Fire Management Plan at 5-year intervals.
  - Monitor and evaluate prescribed burning effects to assist in determining future burn plans.
  - Partner with other natural resource agencies and organizations to implement burn prescriptions.
  
6. Inventory, map, and monitor wildlife and habitats of the northern Everglades. Compile, collect and analyze these data to guide refuge management and to contribute to Everglades restoration evaluations.
  - Compile historic data and establish a continuous data collection and analysis effort.
  - Develop computerized databases to facilitate data storage and retrieval, including Geographic Information System capabilities. These databases will be compatible with Service standards.
  - Through inventory and monitoring, establish trends of sensitive habitats, trust species, and biological indicators (Florida snail kites, wading birds, and alligators) in conjunction with the Science Subgroup on Everglades Restoration.
  - To promote biological diversity on the refuge, develop a program to monitor tree islands so that the effects of management can be assessed.
  - Write the Biological Inventory/Monitoring Plan by 2003.
  
7. Manage the compartments, cypress swamp and Strazzulla Marsh for trust species such as neotropical migrants, shorebirds, waterfowl, wading birds and alligators.
  - Assure that equipment needs are met to fulfil this objective, and develop partnerships with local landowners or agencies.
  - Increase partnerships with the Everglades Agricultural Area landowners and other surrounding landowners.
  - Develop Moist Soil/Water Management Plan for the compartments, cypress swamp and Strazzulla Marsh by 2002.
  
8. Manage and maintain diverse native habitats and viable wildlife populations consistent with sound biological principles and other objectives of this plan.
  - Identify habitat needs through data collection and analyses.
  - Maintain or enhance the habitat of trust species such as threatened and endangered species, species of concern and migratory birds.
  - Enhance trust species nesting success by providing cover, stop-over sites for migratory birds, reducing human disturbance and by providing or creating nesting, roosting and foraging habitat.
  - Support and implement listed species recovery plans.
  - Provide data and analysis to update the Multi-Species Recovery Plan for South Florida.
  - Map native plant communities and incorporate data into Geographic Information System.
  - Monitor changes and trends in wildlife, fish and habitat.
  - Support Partners-In-Flight initiatives with habitat management, outreach and staff networking.
  - Support Partners In Amphibian and Reptile Conservation with habitat management, outreach and staff networking.
  - Write the Biological Inventory/Monitoring Plan by 2003.

*Goal 2. Resource Protection*

Conserve natural and cultural resources through partnerships, protection and acquisition from willing sellers.

## Discussion:

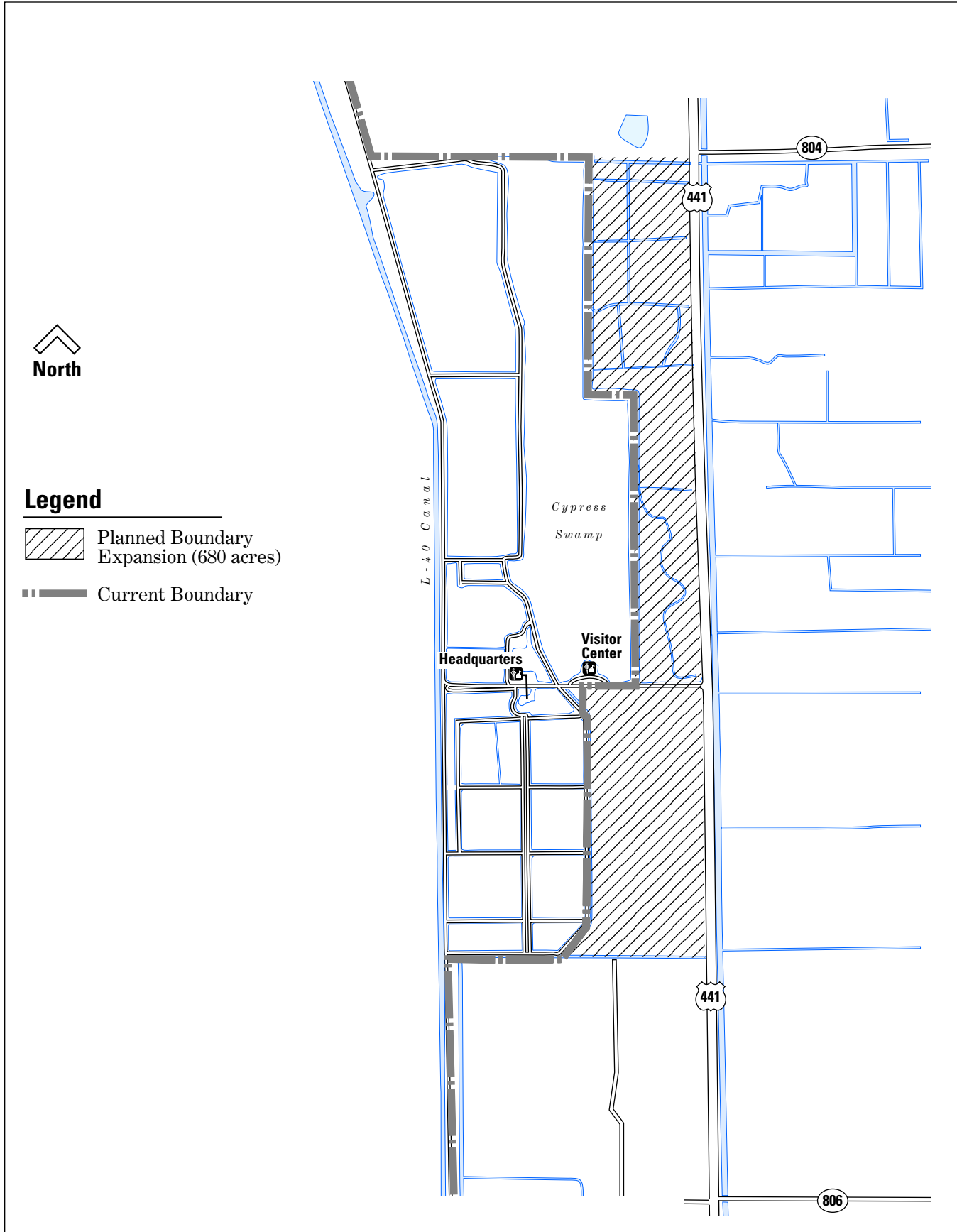
Developing and cultivating active partnerships with a wide ranging group of interested parties is imperative to fully protect and manage refuge resources and to achieve the vision of this plan. The refuge is currently threatened by impending business and residential development on the eastern refuge border. The refuge will adjust the acquisition boundary to include the lands immediately east of the headquarters area (approximately 680 ac., see Figure 12). The refuge recognizes the lands east of the refuge and up to SR 441/7 as “Areas of Concern.” A wide range of partnering opportunities will be actively pursued and fostered to protect natural and cultural resources. The refuge will work with current or new landowners to share easements for wildlife.

## Objectives:

1. Protect water resources and develop partnerships to ensure an appropriate water regulation schedule (water quality, quantity, delivery and timing) for the benefit of wildlife and wildlife habitat of the northern Everglades.
  - Partner with Corps of Engineers, Florida Department of Environmental Protection, South Florida Water Management District, local drainage districts and universities to ensure Class III water quality on the refuge.
2. Protect other natural biological resources on or near the refuge by encouraging communication and developing partnerships with interest groups, landowners, and with the law enforcement division of resource agencies.
  - Work with adjacent landowners to establish an ‘exotic free buffer zone’ and wildlife corridors.
  - Develop partnerships for research, control and monitoring of exotic and invasive species with agencies such as the Florida Exotic Pest Plant Council, Southeast Florida Invasive Plant Working Group and South Florida Water Management District.
  - Develop new and continue existing partnerships for research and monitoring of biological resources with universities, conservation organizations (e.g., Ducks Unlimited, Waterfowl USA, Partners-In-Flight), and agencies (e.g., South Florida Water Management District, Florida Department of Environmental Protection, and Florida Fish and Wildlife Conservation Commission).
3. Change the refuge acquisition boundary and recognize “Area of Concern” lands.
  - The refuge recognizes the lands adjacent to the refuge and east to SR 441/7 as “Areas of Concern” and as a potential buffer zone.
  - Develop collaborative relationships with federal, state, and county land offices, agencies, organizations, and landowners to ensure the “Areas of Concern” remain as agricultural or natural lands.
  - Work with federal, state, and county land offices to acquire approximately 680 acres directly in front of the headquarters area and return them to cypress swamp or wetlands.

4. Protect species from exposure to contaminants by following applicable regulations.
  - Implement Integrated Pest Management Plan
  - Comply with current contaminant response plans.
  - Continue partnerships with agencies testing for mercury levels in fish.
  - Through education and outreach, encourage the use of Integrated Pest Management by Everglades Agricultural Area landowners and other surrounding landowners.
5. Protect refuge resource (147,392 acres) facilities associated with three visitor use areas, and the visiting public using law enforcement.
  - Refuge law enforcement officers will keep informed of refuge programs and will be engaged in educational contacts with the public.
  - Update and enhance the refuge's Law Enforcement Plan by 2002 and establish partnerships with other law enforcement agencies.
6. Develop and implement a cultural resource protection plan in accordance with federal and state historic preservation legislation.
  - Pursue funding for a comprehensive archaeological survey of the refuge.
  - Consult with the State Historic Preservation Office and the Keeper's Office to determine eligibility of each found site for listing on the National Register of Historic Places.
  - Develop a Geographic Information System layer for the refuge's archaeological and historic sites. The archaeological/historic layer will be created by 2001.
  - Develop a Cultural Resource Protection Plan by 2003.
7. Diminish the looting and vandalism of known or newly discovered archaeological sites.
  - Each refuge law enforcement officer will complete the Archaeological Resources Protection Act training course within two years of arriving at the refuge.
  - Pertinent refuge staff will complete the Section 106/Cultural Resources for Managers' training course within two years of arriving at the refuge.
  - Work with the State Historic Preservation Office to ensure confidentiality of cultural resource data within the refuge and the State of Florida.
8. Encourage partnerships to protect cultural resources.
  - Work with the pertinent federal and state agencies, the State Historic Preservation Office, professional archaeologists, Native American communities, and the public.
  - Develop Memorandums of Understanding with pertinent federal and state agencies( e.g., the Florida Department of Environmental Protection) to enhance law enforcement of the Archaeological Resources Protection Act, the Native American Grave Protection and Repatriation Act, and applicable portions of Section 50, Code of Federal Regulations.
  - Facilitate investigations of the Archaeological Resources Protection Act violations and illegal artifact collection on the refuge.
  - Through the efforts of the regional archaeologist, obtain information on and input into the management of significant cultural and sacred sites from Miccosukee Tribe of Indians and the Seminole Tribe of Florida.

Figure 12. Proposed boundary expansion near the headquarters of ARM Loxahatchee National Wildlife Refuge



### Goal 3. Public Use

Develop and implement appropriate, compatible, wildlife-dependent recreation and environmental education programs that lead to enjoyable experiences and greater understanding of the Everglades.

#### Discussion:

As identified in the National Wildlife Refuge System Improvement Act, there are six high priority wildlife-dependent recreation uses: wildlife observation, wildlife photography, hunting, fishing, and environmental education and interpretation. Fundamental to the provision of these uses are viable and diverse fish and wildlife populations and the habitats upon which they depend. These priority uses, along with all other proposed uses, must be compatible with the refuge purposes and the mission of the National Wildlife Refuge System. The compatibility of proposed refuge uses is addressed in Appendix D.

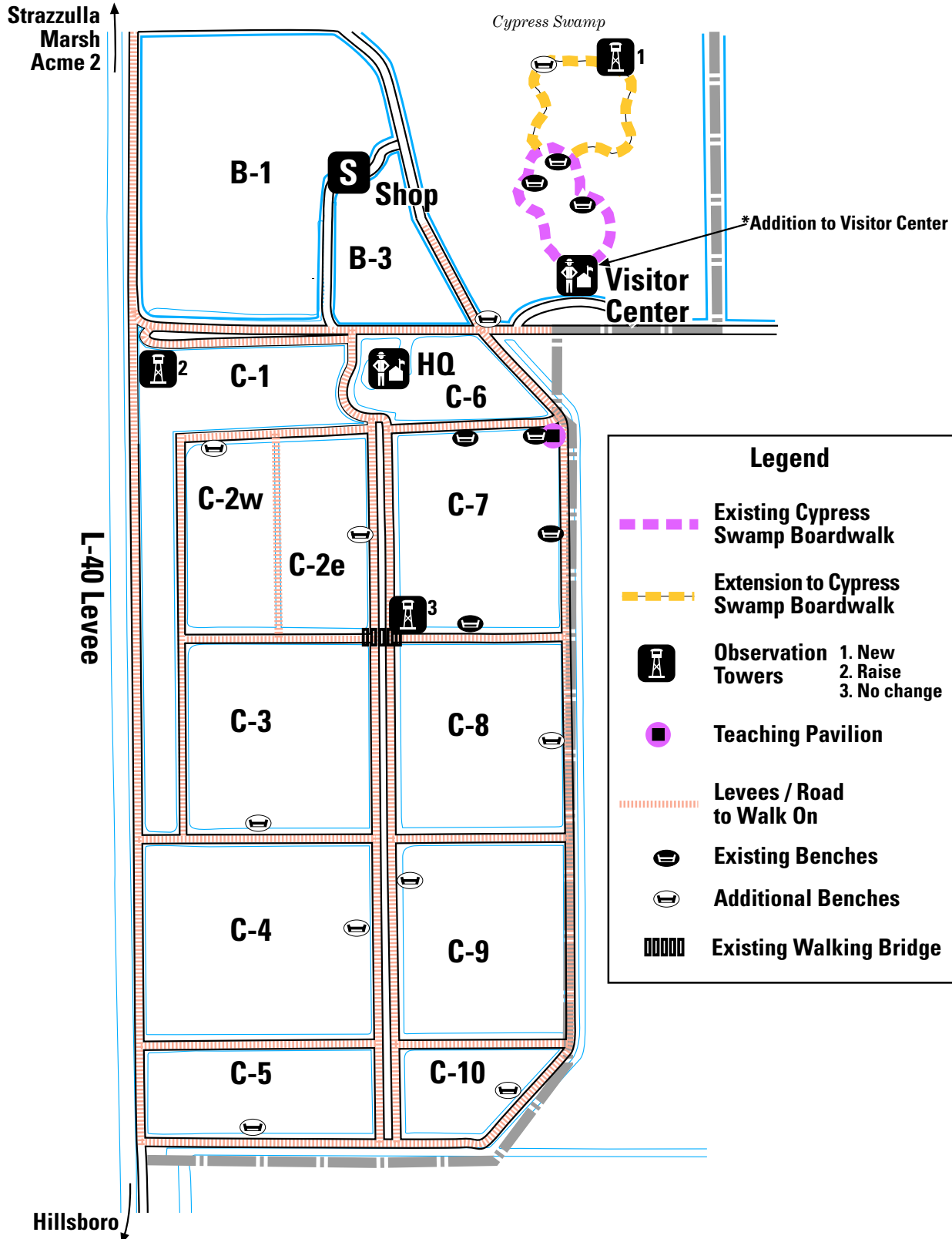
To ensure a quality wildlife-dependent recreational experience, while achieving a “wildlife first” mandate, the number of refuge users and conflicts among users may be limited by (1) permitted uses; (2) designating trails, levees and sites for specific kinds of wildlife-dependent recreation use; and (3) permitting uses at certain times of the year.

There are a number of situations where future refuge closures or restrictions may be warranted. Examples of these situations include, but are not limited to, specific designated use areas; the protection of endangered species (flora or fauna); protection of colonial bird nesting colonies or roost sites, establishment of sanctuary areas for waterfowl, restriction of hunting to certain days of the week; closing a hunt season due to population decline; establishment of hunter quota systems to provide for a high quality hunting experience or to achieve specific wildlife population objectives; minimizing conflicts with other refuge management or public use programs; and/or inadequate funds or staff to administer the activities.

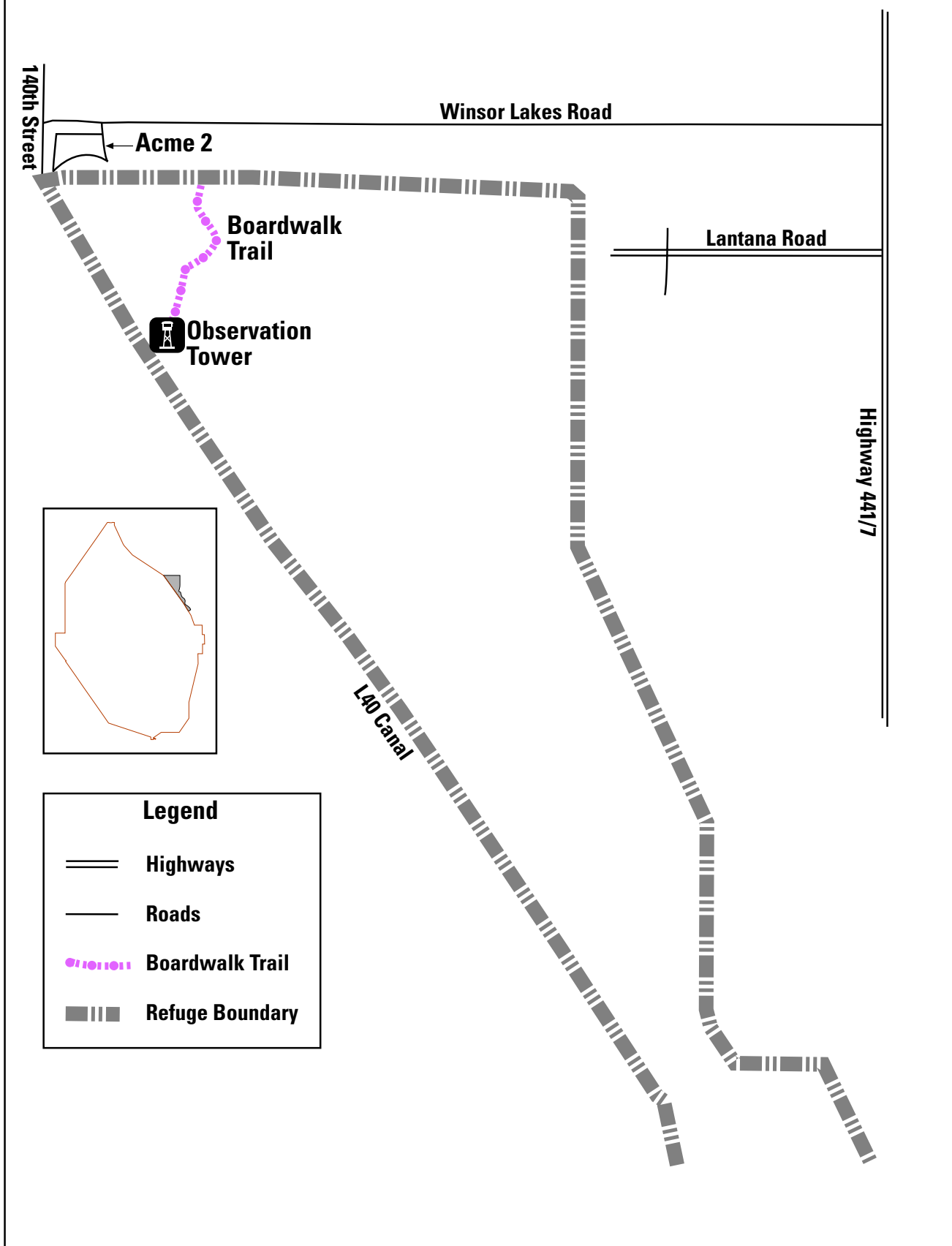
#### Objectives:

1. Expand appropriate, compatible, wildlife-dependent recreational opportunities at the headquarters area (*Figure 13*).
  - Update the existing Public Use Management Plan by 2005 and support Service sanctioned events.
  - Repair existing trails at the headquarters area and meet or exceed the Americans with Disabilities Act code.
  - Extend the cypress swamp boardwalk and construct a 50'-70' observation tower by 2005.
  - Raise the existing observation platform at the boat launch area by 2009.
  - Rebuild the boardwalk into the C-8 impoundment and build a photo blind by 2001.
  - Improve visitor services such as a public telephone, drinking water, toilets, directional signage, improved parking and covered benches.
  - Extend the existing canoe trail at the headquarters area and include an overnight camping platform (depending on logistics and administrative needs).
  - Provide additional benches along C compartment trails.
2. Provide public access into the Strazzulla Marsh (*Figure 14*).
  - Develop nature trails, a sawgrass boardwalk, a 30'-60' observation tower, photoblinds, and interpretive signage.
  - Potentially create a poleboat trail in the refuge interior, with access from Strazzulla Marsh (depending on water quality improvement in the perimeter canal.)

**Figure 13. Proposed Plan: Expanded public use opportunities at the Headquarters area, ARM Loxahatchee National Wildlife Refuge.**



**Figure 14. Proposed Plan: Expanded public use opportunities at Strazzulla Marsh, ARM Loxahatchee National Wildlife Refuge.**



3. Develop a multi-use trail and waterway system.
  - Continue bicycle use of the perimeter levee from the headquarters area to Hillsboro Recreation Area (*Figure 15*).
  - Continue hiking use of the eastern perimeter levee from Hillsboro Recreation Area to the Acme 2 Station just north of Strazzulla Marsh (*Figure 15*). Parking access will be negotiated with the Village of Wellington and the Acme Drainage District.
  - Partner with the South Florida Water Management District to create a walking trail at the toe of the levee from Acme 2 Station to Highway 80 to accommodate hikers on the county proposed green-way.
  - Develop a designated waterway system for motorboats (*Figure 16*).
  
4. In cooperation with state and county natural resource agencies, develop a concession to expand recreational opportunities at the Hillsboro Recreation Area.
  - The concession contract may include a public telephone and restroom facilities, motorboat, canoe and bicycle rentals, fishing guides/gear, interpretive exhibits and a seasonal pontoon boat shuttle service with interpretive guides between Hillsboro Recreation Area, Refuge headquarters and the Strazzulla Marsh.
  
5. The refuge will provide appropriate, compatible, wildlife-dependent fishing and hunting opportunities (*Figure 16*).
  - Develop a hunt plan for alligators and feral hogs, update the waterfowl and the fishing plan by 2004.
  - Host up to four fishing tournaments per year, with very limited participation. This activity may be discontinued pending Service policy.
  - To make the waterfowl hunt area more accessible to motorboats, redefine its boundaries.
  - Eventually increase waterfowl hunt area accessibility by cutting paths through the vegetation on the east side of the refuge interior (depending on water quality improvement in the perimeter canal).
  
6. Develop an environmental education curriculum, by 2002, for use on and off the refuge that centers on providing an understanding and appreciation of the Everglades, the refuge's ecology, and the human influence on ecosystems of southeast Florida. This plan will follow guidelines from the National Outreach Strategy and be part of a strategy to reach key community leaders, like teachers, school board members, elected officials, and the news media (Fish and Wildlife Service 1997e).
  - Update Environmental Education Plan by 2002.
  - Help build community relationship.
  - Include information about the Service and its mission.
  - Increase educational opportunities with the addition of a classroom/ auditorium at the visitor center and a teaching pavilion near the Marsh Trail in the headquarters area.
  - Expand educational topics to include water quality and exotic and invasive plant impacts on the natural environment.
  - Update the environmental education manual to include the Strazzulla Marsh and Hillsboro Recreation areas.
  - Initiate teacher in-service training using the refuge as an outdoor classroom.
  - Make the most effective use of Service resources (for example, teaching teachers). Support specific Service resource priorities as outlined in the National Outreach Strategy (Fish and Wildlife Service 1997e).

- To assist visiting teachers and promote a 'leave no trace' ethic, increase liaisons with county and private school boards to implement a volunteer education and guide program.
- Serve the needs of this field station and reach the broadest possible audience.
- Continue coordinating satellite downlinks with the Service and area schools, and create a downlink site when a refuge classroom is available.
- Create an interactive web site.
- With the assistance of the regional archaeologist and local Native American communities, develop an education program highlighting Native American cultural heritage.

7. Upgrade and expand the interpretive program, portraying the significance of the refuge, and threats affecting the refuge and the south Florida ecosystem. The interpretive program will be updated using the guidelines from the National Outreach Strategy.

- Upgrade the visitor center.
- Help to build community relationship by including information about the Service and its mission.
- Provide multi-lingual brochures and handouts.
- Promote and expand guided tours.
- Enhance and enlarge the Volunteer Speakers Bureau.
- Explore opportunities of greater public investment in the refuge such as a lifetime pass and an 'Adopt-a-Refuge' program.
- Repair, replace and improve interpretive signs.
- Create interpretive signs or kiosks to explain the impoundment management regime at the headquarters area, and to explain the Hillsboro Recreation and Strazzulla Marsh natural areas.
- This field station will build credibility by building relationships with local key figures and establishing its identity and credibility with the local environmental news media. This station will be an integral part of the community in the south Florida area.
- Enhance the current media outreach program.

#### Goal 4. Administration

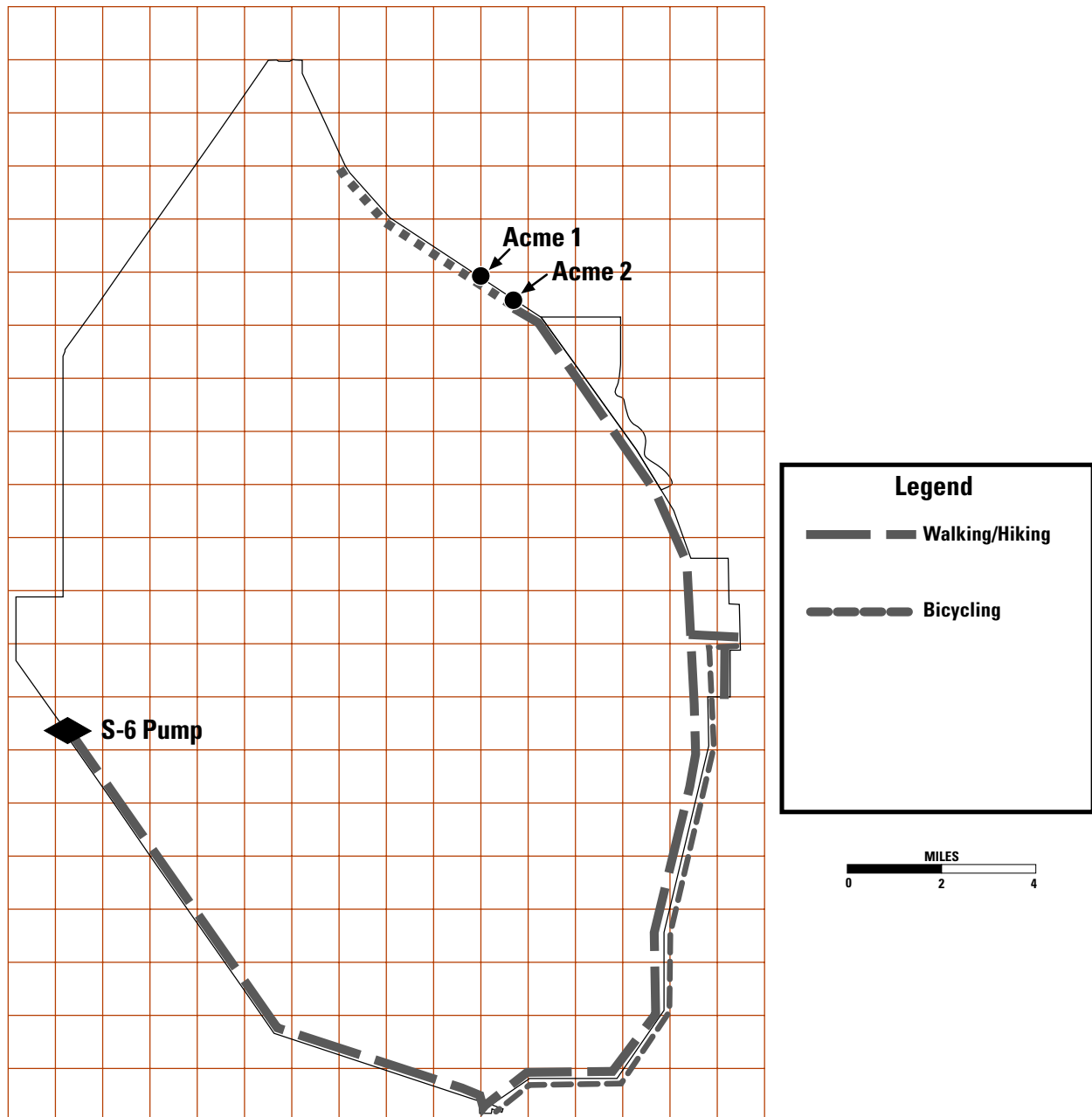
Continue a partnership with the Water Management District through license renewal. Continue the development of an effective and productive staff to achieve the vision, goals, and objectives of this plan.

#### Discussion:

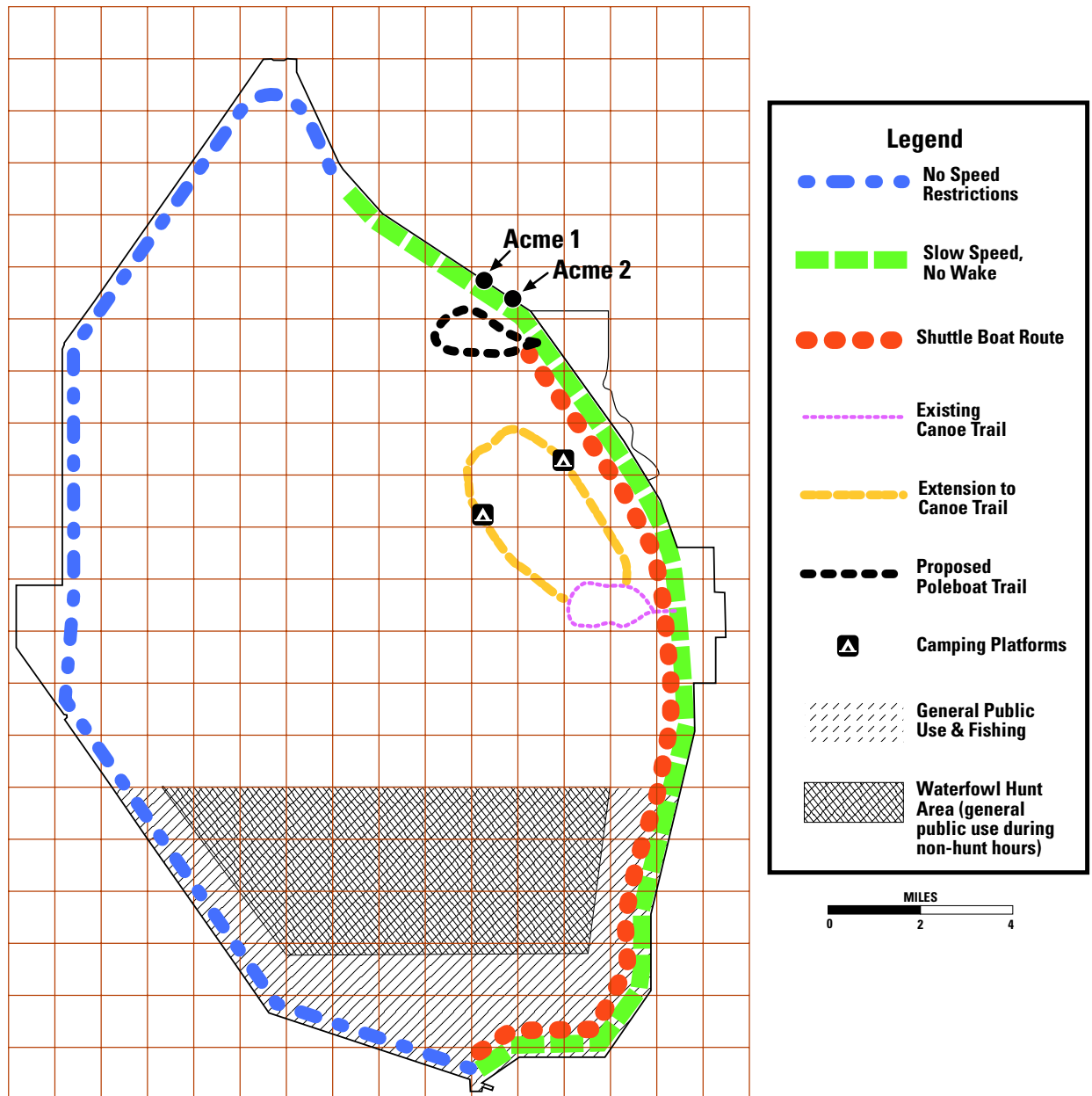
Successful negotiations with the Water Management District which leads to signing a new license agreement is fundamental to the implementation of this plan. The license agreement will continue to allow the Service to manage the wildlife and associated habitats in Water Conservation Area 1 as Arthur R. Marshall Loxahatchee National Wildlife Refuge for future years. Important to the successful management of the refuge is the development of inventory systems and team work by the staff.

1. By October 1, 2000, work with the Water Management District to sign a new license agreement.
2. Expand current staff to accomplish additional priority refuge operations and maintenance.
3. Continue developing internal Service and external partnerships to share equipment and manpower.

**Figure 15. Proposed Plan: Public use opportunities and land use zones on the L-40 Levee, ARM Loxahatchee National Wildlife Refuge.**



**Figure 16. Proposed Plan: Expanded public use opportunities and waterway zones, ARM Loxahatchee National Wildlife Refuge.**





## V. Plan Implementation

The future of this and most national wildlife refuges is dependent upon a public constituency that is knowledgeable of refuge resources and mandates, as well as environmental issues, and is willing to work toward resolving them. To build and maintain this needed constituency, this plan not only provides actions to protect, restore, and conserve wildlife habitat, but also expanded educational and appropriate, wildlife-dependent recreational opportunities. Developing partnerships among our



*Nesting Great blue herons*  
USFWS Photo

constituencies is the common thread to implementing these actions and opportunities. Promoting the refuge as an asset of Palm Beach County will enhance the refuge's image and help expand local support. To achieve the proposed management plan for the refuge, this section identifies projects, staff development and equipment needs, staffing and funding needs, partnership opportunities, step-down management plans, and a biological monitoring and evaluation plan.

### Project Summaries

Listed below are project summaries and their associated costs for land acquisition; facility development and maintenance; biological baseline data collection, manipulation and interpretation;

and exotic plant control and habitat restoration over the next 15 years. While this project list is not intended to be all inclusive, it does reflect the basic needs identified by the public, planning team members, and refuge staff based upon available information. These projects were generated for the purpose of achieving refuge objectives and strategies, and the primary linkages of these projects to those planning elements are identified in each summary.

### *Wildlife Habitat and Population Management*

#### Project 1a.

#### *Invasive Exotic Plant Species Control*

*(Melaleuca and Old World climbing fern only)*

Plant species such as melaleuca and Old World climbing fern presently infest more than 95,000 acres of the refuge and are expanding over 4,000 acres per year. These exotics are out-competing native vegetation and altering Everglades ecology. Since past research and control efforts have not kept up with the rate of spread, a significant increase in funding for aerial and ground controls is needed. Most recent contracts for ground control cost in excess of \$200 per acre for melaleuca; an aerial application costs \$300-\$400 per acre. In addition to control efforts, funding is also needed for research related to biological controls in partnership with the US Department of Agriculture's research and quarantine facility in Broward County. The encouraging news, at least as it relates to melaleuca, is that there are several promising insects that feed specifically on this species and can be used as bio-controls. Unfortunately, there are no known bio-controls for Old World climbing fern and labor intensive control is approximately \$1000/acre. To effectively tackle this significant threat to refuge habitats \$3,000,000 will be needed for the first few years to make

a large dent in the infestation while bio-controls are tested on melaleuca and discovered for Old World climbing fern. Lesser amounts of funding will be needed for maintenance control of the new growth. An ecologist, knowledgeable in exotic plants and animals, will be needed (\$61,300). In addition, mapping is needed to understand existing conditions, plan control strategies, evaluate habitat conditions, and provide long term monitoring. A one-time mapping contract with the U.S. Geological Survey, Biological Resources Division, would cost \$280,000 and would need to be updated every 5 years. The hope is that 5 years of significant funding towards mechanical/herbicidal control will allow enough time for research efforts to produce bio-controls that will work effectively. Obviously, if bio-controls can be introduced earlier funding could be reduced. After five years, funding would still be needed to enable maintenance control of existing invasive exotics and to be pro-active in response to new threats. The warm subtropical environment of south Florida is conducive to the growth and establishment of exotic plant species. Close monitoring and action is needed to prevent future exotic threats from reaching epidemic proportions. The estimated cost of this project is \$3,340,000 for the first year and \$3,000,000 for the following years until the full effects of bio-controls impact the exotics on the refuge. Then recurring base or annual funding for maintenance control should be at least \$500,000 per year. (Linkage: Goal 1, Objectives 1, 3,5,8).

#### Project 1b.

##### *Invasive Exotic Species Control (animals and other plants)*

Very little is known about the ecology, range, or abundance of most of the 89 species of Florida's non-indigenous (exotic) aquatic animals, including those that inhabit the refuge. Walking catfish, oscar, tilapia and others have infested the refuge waters for years. Exotic fish species are discovered each year and it is thought that these species pose a threat to biodiversity on par with habitat loss and degradation. Serious new threats include the Asian swamp eel, a South American armored catfish, and a bromeliad weevil which are poised to infiltrate the refuge waters and vegetation. An exotic fish survey would cost \$ 10,000 and an exotic plant survey (other than melaleuca or Old World climbing fern) would cost \$ 5,000 with updates every five years. In addition, mapping is needed to understand existing conditions, plan control strategies, evaluate habitat conditions, and provide long term monitoring for these exotic animals. The estimated cost for this project is \$20,000 with recurring costs of \$3000 a year (Linkage: Goal 1, Objective 4, 8).

#### Project 2.

##### *Water Quality/Quantity Monitoring*

A hydrological computer model is needed to predict the potential impacts to wildlife and habitats under the new Everglades hydrologic regime. This model would enable managers to recommend changes in the regime that would minimize impacts and provide critical data to evaluate long term impacts to the refuge under different restoration alternatives (\$200,000/yr for five years). Increased water quality monitoring for pesticides, herbicides, fertilizers and heavy metals throughout the refuge, including the cypress swamp, marsh, and impoundments is needed. This will include analyzing water and soils as well as the body burdens in fish, amphibians and waterfowl (\$75,000). The estimated cost for this project is \$275,000, with recurring costs of \$200,000 per year. (Linkage: Goal 1, Objective 2,6 : Goal 2, Objective 1 : Goal 3, Objective 6).

#### Project 3.

##### *Implement a Fire Management Program*

Fire has historically been a natural part of the Everglades ecosystem. Due to the burgeoning population on the east coast and air quality standards it is difficult to use prescribed fire, although it is a preferred management tool. Research is needed to better understand different aspects of the natural role of fire in the northern Everglades system, the effect of fire on tree islands, and the potential effects of increased loads of phosphorous

to topsoil released by fire. In addition, studies are needed to implement safe and effective prescribed fires, and to design burn units (areas to be burned) and frequency models (determine how often to burn, what the plant communities and wildlife responses would be to fire at different times of year and under various water depths. The studies would be contracted to a university or the U.S. Geological Survey, Biological Resources Division, at \$100,000 per year.

To manage the research contracts, a fire management officer, or a prescribed fire specialist, (\$61,300 per year) is needed with an understanding of the role of fire in the Everglades ecosystem, the constraints exotics place on the system and the benefits of prescribed burning on exotic plants. A fire technician would also be needed (\$33,500). Refuge impoundments within compartments would be burned on a rotational basis to reduce undesirable vegetation and provide quality wildlife habitat. Specific areas of the refuge interior would be burned to reduce the biomass of treated melaleuca and rank cattail vegetation. The initial cost for this project is \$200,000 with recurring costs of \$200,000 a year. (Linkage: Goal 1, Objective 3,5,8 ; Goal 3, Objective 1).

#### Project 4.

##### *Inventory and Monitor Everglades Restoration Success*

The recovery and maintenance of healthy populations of threatened, endangered, keystone, and indicator species and habitats are important goals of the refuge system and Everglades restoration. A project would be initiated to compile in a computerized data base, all biological data collected on the refuge from its creation. Studies would be initiated to gather data on the life histories and habitat use of key species and habitats such as Florida snail kite, American alligator, migratory birds, wading birds, fish and tree islands. Collection of these data will permit the refuge to evaluate the overall success of restoration efforts and guide future management decisions. A biologist would be hired to assist with surveys, data collection and entry, and analysis. Estimated costs include \$120,000 for start-up costs for a biologist and equipment, with recurring annual costs of \$50,000. (Linkage: Goal 1, Objective 1,2,6,8 ; Goal 2, Objective 2.)

#### Project 5.

##### *Geographic Information System Database*

Geographic Information System technology enables better mapping, evaluation, and presentation of the diverse and dynamic northern Everglades habitats, of which the refuge is a part. A Geographic Information System workstation would be purchased to enable staff, researchers, and partners to evaluate multi-layered spatial data including habitat, wildlife, exotic species, and results of management decisions. A GIS position is needed to manage the system and data (\$50,800). Estimated costs are \$90,000 for the first year, with recurring costs of \$60,000 annually. (Linkage: Goal 1, Objective 2,3,4,5,6,7,8 ; Goal 2, Objective 3.)

#### Project 6.

##### *Monitor Dynamic Northern Everglades Vegetation Patterns*

The imperiled northern Everglades is a dynamic system resulting in continuous changes in vegetation patterns in response to hydrology, fire, elevation, and soils. This project will compile data from all past studies on vegetation change in the refuge and re-sample 1-square-mile photo plots. Several studies, conducted on the refuge since the 1940s, can serve as the foundation for future studies. This project, estimated to cost \$60,000, would enable the refuge to gain a greater understanding of ecosystem processes and would assist in making future management decisions. This project would be updated every 5 years at an estimated cost of \$25,000 to evaluate refuge management and the Comprehensive Everglades Restoration Plan. (Linkage: Goal 1, Objective 2,3,4,5,6,7,8 ; Goal 2, Objective 2.)

## Project 7.

*Manage Compartments A, B, C, and D for Trust Species*

Compartments A-D comprise 2,550 acres of habitat available for more intensive management. One of the least represented components of the historic system is forested wetlands. A minimum of 500 acres in compartment A could be replanted in pond cypress, pond apple and other trees native to this plant community (\$70,000). A mosaic of habitats will be created through active water manipulation and prescribed burning to provide foraging needs of migrating shorebirds, nesting wading birds, waterfowl, and raptors. Thirteen impoundments totaling 725 acres need to have several water control structures replaced or repaired (\$70,000). New pumps are needed at both the north and south ends (\$325,000) and all perimeter canals need to be cleaned (\$170,000) to improve water delivery. A seepage pump with automatic settings is needed at Compartment D to facilitate water management and resolve disputes with neighboring landowners and the Water Management District (\$85,000). In order to effectively manage water and maintain water facilities, a maintenance position would be needed (\$43,300). The estimated cost for this project is \$1,088,300 with recurring costs of \$110,000 annually. In addition, staff would provide technical assistance and develop grants for partnerships with state, county, and private landowners to enhance habitat management for trust species throughout Palm Beach County. (Linkage; Goal 1, Objective 3,4,5,7,8; Goal 3, Objective 1.)

*Resource Protection*

## Project 8.

*Boundary Line Location*

Several portions of the refuge boundary have become overgrown with vegetation or impacted by adjoining developments. At least 20 miles of boundary would be located to clearly establish the refuge boundary. Estimated cost is \$75,000, (Linkage: Goal 2, Objective 3,5,6,7.)

## Project 9.

*Land Acquisition*

To protect the integrity of the refuge, it is necessary to acquire nearby lands or enter into management agreements with other governmental entities. Staff are particularly concerned about extending the refuge boundary to include a narrow strip of land (about 680 acres) or entering into a partnership to manage lands just east of the visitor center and refuge impoundments. Such lands would buffer the effects of urban development adjacent to the refuge. While several efforts are underway to acquire lands along the eastern boundary--either as water preserves (as part of the Comprehensive Everglades Restoration Plan- Everglades Construction Project) or as environmentally sensitive lands (as part of Palm Beach County's East Coast Buffer Project and Agricultural Reserve Program)--there is a possibility that this acreage may not be acquired under these programs. If this is the case, leases, easements or management partnerships are the preferred choice to protect these lands. Land purchase estimates could range between \$2 - 6 million. Lands acquired could be replanted in cypress to restore the forested wetland component of the Comprehensive Everglades Restoration Plan. (Linkage: Goal 2, Objective 3; Goal 1, Objective 8.)

*Public Use*

## Project 10.

*Expand Recreational Opportunities at Headquarters Area*

While the refuge has the second highest visitation among outdoor attractions in Palm Beach County, its visitor center is limited in its ability to provide interpretive exhibits and programs to a rapidly expanding nearby population of 6 million people. Construction of an additional building, to mirror the existing one, will double the space to 5,000 square feet and provide an expanded display area with interactive exhibits, additional office space, expanded cooperating association sales area, and a

larger auditorium with a connected wet lab for school classes. The Service will contract for construction of the building (\$650,000) as well as new exhibits (\$400,000). Existing levees will be opened for wildlife observation and hiking in Compartment A and interpretive signs will be installed (\$25,000). A senior public use specialist (\$70,300 per year) is needed to coordinate outreach, planning, and interpretive programs for this refuge as well as for Hobe Sound National Wildlife Refuge--which is administered by Loxahatchee refuge. In addition, a park guide (\$39,600) would be hired to assist with interpretive tours and programs. The existing canoe trail will be extended and two camping platforms (\$16,000 each) and two composting toilets (\$3000 each) will be added to allow overnight platform camping. The canoe trail will need to be maintained four times a year (\$10,000) with a mechanical cutting machine and \$10,000 will cover administrative costs and possible lost canoeist rescues. The cost of the canoe trail extension and camping platforms will be \$58,000. The total cost for this project is \$1,274,000 with recurring costs of \$160,000 annually. (Linkage: Goal 3, Objective 1,3,6,7.)

#### Project 11.

##### *Develop Public Use Facilities at Strazzulla Marsh*

Additional access and public use facilities are needed at the north end of the refuge to accommodate people residing in the northern part of Palm Beach County as well as the Village of Wellington. Facilities will be developed for wildlife-dependent recreation including a disabled-accessible fishing pier, elevated observation tower and boardwalk, possibly a pole boat launch, a vehicle and trailer parking area, interpretive panels, information and directional signing, and restrooms. This development will also serve as an access point for hiking use associated with the proposed multi-use trail that will connect with the county's planned Greenways' Project at the northern tip of the refuge by 20-Mile Bend. Public access and a vehicle parking lot will be negotiated with the Village of Wellington and the Acme Drainage District. A maintenance person would be hired for the upkeep and repair of this and other refuge facilities. Estimated costs would be \$275,000 for construction and start-up, with salary and maintenance costs running \$40,000 annually. (Linkage: Goal 3, Objective 2,5,7.)

#### Project 12.

##### *Expand Recreational Opportunities at Hillsboro Recreation Area*

This southernmost access point to the refuge is heavily used by residents from Palm Beach and Broward counties. While the parking lot has been graveled and existing boat ramps are scheduled for refurbishment, facilities are still limited. A new visitor center would be built for refuge staff, volunteers and the Loxahatchee Natural History Association; this center would provide information about the refuge as well as contain interpretive exhibits. Efforts would be made to partner with the Florida Fish and Wildlife Conservation Commission and the South Florida Water Management District to convey the value of the Everglades and restoration efforts.

A contract would be awarded to establish a concession operation; this concession may provide the following recreational opportunities: canoe and boat rentals, fishing equipment and guides, bicycle rentals, and, if possible, pontoon boat trips up to the Headquarters and Strazzulla Marsh areas. The concessionaire may also supply equipment, rentals, and guides to support recreational opportunities in Water Conservation 2A which is adjacent the refuge. A refuge ranger position (\$41,400) would be filled to enhance recreational opportunities and a law enforcement officer would be stationed at this site (\$46,200). Projected start-up costs will run \$350,000, with recurring costs of \$87,600 annually. (Linkage: Goal 3, Objective 3,4,5,6,7.)

#### Project 13.

##### *Provide Additional Fishing and Hunting Opportunities*

Developing additional public hunting opportunities (alligator and feral hog) will require additional administrative and overtime costs. Increasing

accessibility at the south end of the refuge for waterfowl hunting and fishing will require establishing contracts for trail maintenance. The estimated cost of this project is \$50,000, with recurring costs of \$15,000 annually. (Linkage: Goal 3, Objective 4,5.)

#### Project 14.

##### *Expand Environmental Education and Outreach Opportunities*

To accommodate the increasing interest in environmental education by the expanding school systems in Palm Beach and Broward counties, a new curriculum, developed for use by educators on and off the refuge, will center on conveying the importance of the Everglades and refuge habitats as well as the impacts of human development. An open air pavilion (a roof and screen walls) will be constructed near the marsh trail for teaching visiting school classes. Outreach opportunities will be expanded and enhanced through public service materials, brochures, and a web site to reach an expected five million south Florida residents. Costs for construction and start-up will run \$150,000, with recurring costs of \$10,000 annually. (Linkage: Goal 3, Objectives 6, 7.)

#### *Administration*

#### Project 15.

##### *Base Maintenance Funds*

With expanded operations and facilities benefitting resource and public use programs, there is a need to develop an effective pro-active maintenance program. Additional funding is needed to maintain existing refuge facilities as well as expand and maintain the refuge's water and sewage treatment plants. A minimum level of parts and supplies needs to be available for immediate use. Scheduled inspections of all buildings, vehicles, and equipment need to be implemented to enable long term use. Annual costs for this additional support will be \$100,000. (Linkage: Goal 4, Objectives 2,3.)

**Table 8. Project Cost Summary**

<i>Project</i>	<i>Total Cost</i>	<i>Recurring Base</i>
1a. Invasive exotic plant species control (plants)	\$3,340,000	\$3,000,000*
1b. Invasive exotic species survey (other)	\$20,000	\$3,000
2. Water quality/quantity monitoring	275,000	200,000
3. Fire management program	200,000	200,000
4. Monitor everglades restoration	120,000	50,000
5. GIS database	90,000	60,000
6. Monitor vegetation patterns	60,000	25,000
7. Manage compartments	1,088,300	110,000
8. Boundary line surveys	75,000	----
9. Land acquisition	2 - 6,000,000	----
10. Expand recreation-headquarters area	1,274,000	160,000
11. Public use area - Strazzulla	275,000	40,000
12. Expand recreation - Hillsboro	350,000	87,600
13. Expand hunting and fishing	50,000	15,000
14. Expand environmental ed. and outreach	150,000	10,000
15. Base maintenance	----	100,000
Totals:	\$7,367,300	\$4,060,600
	w/out land acquisition	

\*The 'Recurring Base Cost' for project 1a will diminish over time as bio-controls are released and become more effective against melaleuca and Old World climbing fern.



*Data collection  
USFWS Photo by M. Bailey*

### **Staffing and Funding**

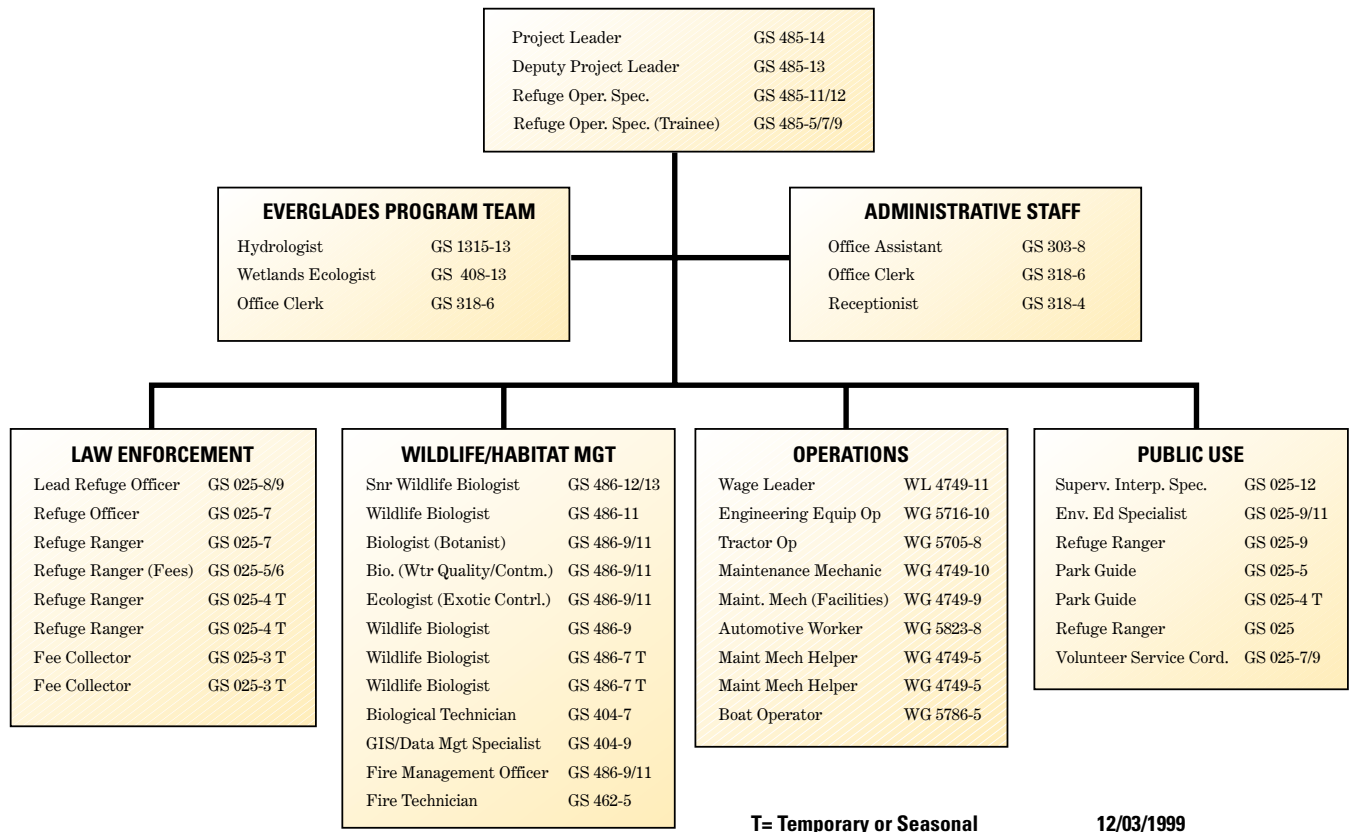
Currently a staff of 23 permanent and 13 temporary/seasonal positions has been approved by the Regional Office for the refuge, but current funding covers only 20 permanent and 4 temporary/seasonal positions. In the recent past, most of the temporary/seasonal personnel have been used for melaleuca control or for the entrance fee program. Since the plan calls for contracting out exotic species control and fee collection procedures and compliance monitoring have been improved, the number of “seasonals” was reduced to four positions.

To complete the extensive wildlife management and restoration projects and increase inventorying, monitoring, and mapping projects more permanent staff will be needed, including a refuge operational specialist (trainee), an office clerk, a receptionist, a law enforcement refuge ranger, a botanist, an ecologist, a wildlife biologist, a geographic information system specialist, a fire management officer, a fire technician, a wage leader in the shop area, a tractor operator, a maintenance mechanic, a maintenance mechanic helper, a boat operator, an interpretive refuge ranger, a park guide and a volunteer services coordinator. Additional seasonal positions are proposed to expand the programs identified in the plan including a refuge ranger (law enforcement) and interpretive park guide during our heavy use periods and two wildlife biologists during critical census/inventory time periods. The staffing plan (*Figure 17*), proposed at full development level, would achieve the plan objectives and strategies within a reasonable time period. The annual costs (salary including benefits) of the proposed staffing plan is shown in Table 9. The rate at which this refuge achieves its full potential of contributing locally, regionally, and nationally to wildlife conservation, appropriate compatible wildlife-dependent recreation, and environmental education is totally dependent upon receiving adequate funding and staffing.

\* Law enforcement enhanced pay,  
Salary including benefits (calculated  
at the highest potential wage  
possible,  
including for each position, using  
FY-2000 wage scales).  
T- temporary or seasonal

**Table 9. Annual cost of proposed staff positions for ARM Loxahatchee National Wildlife Refuge**

<i>Title</i>	<i>Grade</i>	<i>Annual Cost*</i>
Project Leader	GS-0485-14	\$104,400
Deputy Project Leader	GS-0485-13	\$88,400
Refuge Operations Specialist	GS-0485-11/12	\$74,300
Refuge Operations Specialist (trainee)	GS-0485-5/7/9	\$51,200
<i>Everglades Program Team</i>		
Hydrologist	GS-1315-13	\$88,400
Wetlands Ecologist	GS-0408-13	\$88,400
Office Clerk (EP Team only)	GS-0318-6	\$37,700
<i>Administrative Staff</i>		
Office Assistant	GS-0303-8	\$46,400
Office Clerk	GS-0318-6	\$37,700
Receptionist	GS-0318-4	\$30,200
<i>Law Enforcement</i>		
Lead Refuge Officer	GS-0025-9/11*	\$62,000
Refuge Ranger	GS-0025-7*	\$46,200
Refuge Ranger	GS-0025-7	\$41,900
Refuge Ranger (Fees)	GS-0025-5/6	\$37,700
Refuge Ranger	GS-0025-4 T	\$13,200
Refuge Ranger	GS-0025-4 T	\$13,200
Fee Collector	GS-0025-3 T	\$11,800
Fee Collector	GS-0025-3 T	\$11,800
<i>Wildlife/Habitat Management</i>		
Senior Wildlife Biologist	GS-0486-12/13	\$88,400
Wildlife Biologist	GS-0486-11	\$62,000
Biologist (Botanist)	GS-0486-9/11	\$62,000
Biologist (Water Quality & Contaminants)	GS-0486-9/11	\$62,000
Ecologist (Exotic Control)	GS-0486-9/11	\$62,000
Wildlife Biologist	GS-0486-9	\$51,200
Wildlife Biologist	GS-0486-7 T	\$18,400
Wildlife Biologist	GS-0486-7 T	\$18,400
Biological Technician	GS-0404-7	\$41,900
GIS/Data Management Specialist	GS-0404-9	\$51,200
Fire Management Officer	GS-0486-9/11	\$62,000
Fire Technician	GS-0462-5	\$33,800
<i>Maintenance Operations</i>		
Wage Leader	WL-4749-11	\$52,700
Engineering Equipment Operator	WG-5716-10	\$45,100
Tractor Operator	WG-5716-8	\$39,600
Maintenance Mechanic	WG-4749-10	\$45,100
Maintenance Mechanic (Facilities)	WG-4749-9	\$42,300
Automotive Worker	WG-5823-8	\$39,600
Maintenance Mechanic Helper	WG-4749-5	\$31,200
Maintenance Mechanic Helper	WG-4749-5	\$31,200
Boat Operator	WG-5786-5	\$31,200
<i>Public Use</i>		
Supervisory Interpretive Specialist	GS-0025-12	\$74,300
Environmental Education Specialist	GS-0025-9/11	\$62,000
Refuge Ranger	GS-0025-9	\$51,200
Refuge Ranger	GS-0025-7	\$41,900
Park Guide	GS-0025-5	\$33,800
Park Guide	GS-0025-4 T	\$13,200
Volunteer Services Coordinator	GS-0025-7/9	\$51,200
Subtotal (annual staff costs)		\$2,183,800
Annual fixed costs (phone, gas, diesel, electric, travel, equipment repair, equipment and building maintenance, etc.)		\$185,000
Total Annual Cost		\$2,368,800

**Figure 17. Proposed staffing plan for ARM Loxahatchee National Wildlife Refuge****Partnership Opportunities**

To achieve the goals and objectives of this plan, maintaining existing partnerships and developing new ones with a variety of resource agencies, organizations and individuals is essential (for a list of existing and potential partners, see Appendix M). Partnerships will not only enable the refuge to fulfill plan objectives, but also minimize costs.

As reflected in the management objectives, Loxahatchee refuge is one of the key players in the restoration of the northern Everglades. Coordination with agencies, organizations, and individuals involved with Everglades restoration will ensure that refuge management remains consistent with ecosystem restoration objectives.

Effective management of water quality, quantity, and timing is critical to achieve wildlife habitat and population objectives in the refuge interior. To these ends, partnerships will be developed with adjacent landowners, South Florida Water Management District, Lake Worth Drainage District, Corps of Engineers, and the Florida Department of Environmental Protection. To maintain and enhance wildlife habitat outside of the refuge, the Service will focus its efforts on developing partnerships with the Village of Wellington and farmers in the Everglades Agricultural Area.

Collaboration with colleges, universities, and conservation organizations will enable the refuge to carry out its extensive plans for research, monitoring, and education. To create awareness and expand environmental education efforts in the community, partnerships will be established with organizations and school systems. The refuge's existing relationship with its cooperating association, the Loxahatchee Natural History Association, will be enhanced and similar partnerships will be pursued with other support groups to meet other refuge needs.

**Table 10. Step-Down Management Plans and completion dates, arranged by issue sequence in the goals and objectives portion of the plan**

<i>Step-Down Plan</i>	<i>Completion Date</i>
Integrated Pest Management Plan	2002
Exotic Plant Control Plan	2003
Exotic Animal Control Plan	2005
Water Quality Monitoring Plan	2002
Biological Inventory/Monitoring Plan	2003
Moist Soil/Water Management Plan	2002
Fire Management Plan (Update)	2002
Law Enforcement Plan	2002
Cultural Resource Protection Plan (Update)	2003
Public Use Management: General Plan (Update)	2005
Public Use Management: Environmental Education Plan (Update)	2002
Public Use Management: Fishing Plan (Update)	2004
Public Use Management: Hunt Plan (Update)	2004
Alligator Hunt Plan	2004
Feral Hog Hunt Plan	2004
Waterfowl Hunt Plan (Update)	2004
Public Use Management: Signs (Update)	2004

### **Step-Down Management Planning**

A comprehensive conservation plan is a strategic plan that guides the future direction of the refuge. Before some of the strategies and projects can be implemented, detailed step-down plans will need to be prepared or updated. To assist in preparing and implementing the step-down plans, refuge staff will develop partnerships with local agencies and organizations. These plans, listed in Table 10 and described below, will be developed in accordance with the National Environmental Policy Act, which requires the identification and evaluation of alternatives and public involvement prior to their implementation.

Table 10. Step-Down Management Plans and completion dates, arranged by issue sequence in the goals and objectives portion of the plan.

#### *Integrated Pest Management Plan*

Draft Completion 2002

This plan will address the complex issue of bringing exotic plants and animals to a maintenance control level on the refuge. It will cover chemical herbicide use (aerial and ground level), mechanical eradication and the use of bio-controls. The Exotic Plant and the Exotic Animal Control Plans will be sections within this plan.

#### *Exotic Plant Control Plan (Update)*

Completion 2002

This plan (as part of the Integrated Pest Management Plan) will bring exotic and invasive plants to a maintenance control level as soon as possible. It will identify current infestation levels of the major exotic or invasive plants on the refuge and outline methods for controlling and monitoring these plants. Survey and control methods will also be identified for non-major exotic and invasive exotic plants.

### *Exotic Animal Control Plan*

Completion 2002

This plan (as part of the Integrated Pest Management Plan) will describe survey, removal and monitoring techniques for both terrestrial and aquatic invasive and exotic animals (vertebrate and invertebrates).

### *Water Quality Monitoring Plan*

Completion 2002

This plan will address monitoring stations, needed and ongoing research, minimal standards and partnerships. It will include the stipulations set forth in the Consent Decree. This plan will ensure that all refuge water quality meets the standards of the Department of Environmental Protection and the Environmental Protection Agency for Class III and Outstanding Florida Waters. It will address research and monitoring needs to meet these water quality standards and will identify the location of monitoring sites, frequency of monitoring, and methods of evaluation.

### *Biological Inventory/Monitoring Plan*

Completion 2003

This plan will describe inventory and monitoring techniques and time frames. All plant communities and associations in the refuge as well as all trust species (migratory birds including shorebirds, neotropical passerines and waterfowl), listed species (federal and state threatened, endangered, and species of concern) and key species shall be inventoried, and population trends will be monitored. These data are essential to guide wildlife habitat management on the refuge.

### *Moist Soil/Water Management Plan*

Completion 2002

This plan will identify the procedures for managing the compartments and the cypress swamp for optimal wildlife benefits, including methods, timing and implementation.

### *Fire Management Plan (Re-write)*

Completion 2002

Updating this plan and implementing will result in more aggressive wildlife habitat management in the refuge interior. This plan will also include fire management in other areas of the refuge, including all the compartments and Strazzulla Marsh.

### *Law Enforcement Plan (Update)*

Completion 2002

Updating this plan will reflect objectives and strategies of the comprehensive conservation plan.

### *Cultural Resource Protection Plan*

Completion 2003

This plan will identify and seek to protect archeological sites. Development of this plan, written by the Service's Regional Archaeologist, will involve consultation with federally recognized Native American nations, the State Historic Preservation Office, and other professional archaeologists.

### *Public Use Management: General (Update)*

Completion 2005

This plan will address appropriate, compatible, and wildlife-dependent recreation issues including facility upgrades, handicapped accessibility, types of recreation, accessibility and concession usage.

### *Environmental Education Plan (Update)*

Completion 2002

This update will reflect the objectives and strategies of the comprehensive conservation plan, and address environmental education guidelines following Sunshine State standards. As a part of this plan, an education manual will be created that follows the plan and Fish and Wildlife Service guidelines for environmental education.

### *Hunt Plan and Fishing Plan (Update)*

Completion 2004

This updated plan will reflect the comprehensive conservation plan's objectives and strategies regarding select species including alligators, feral hogs and waterfowl. It will identify species to be hunted, seasons, limits (dependent upon biological survey findings), hunt areas, accessibility, hunt methods and other regulations applicable to species hunting regulations. This update will address specific aspects of the refuge fishing program, including boat speeds, fishing boundaries, needed facilities and applicable fishing regulations.

### *Sign Plan (Update)*

Completion 2004

In this plan, signs will be redesigned, incorporating Fish and Wildlife Service guidelines.

## **Monitoring and Evaluation**

Effective long-term management of the refuge will depend on baseline inventories and periodic monitoring and evaluation of refuge resources.



*Monitoring vegetation density  
USFWS Photo by M. Bailey*

Data generated from inventory and monitoring efforts will enable refuge staff to determine the status and trends of key species and habitats. These data will be incorporated into a geographic information system, which will enable refuge staff to evaluate the effects of alternative habitat management techniques, exotic plant control methods, and changes in water quality on these species and habitats.

These efforts will enable the refuge to evaluate the achievement of the proposed objectives and strategies identified in the comprehensive conservation plan and if necessary make adjustments in the plan and test new management techniques. Thus, adaptive management, as it is called, is a flexible approach to the long-term management of resources that is guided by the results of ongoing inventory and monitoring activities.